Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:**	Problem	**FIAR**	**IFA** STS-66-V-01	OMS/RCS
PROP-01	**GMT:**		**SPR** 66RF01	**UA**	**Manager:**
			IPR	**PR** LP03-18-0478	
					Engineer:

Title: Aft Thruster L1A Failed Off (ORB)

Summary: INVESTIGATION/DISCUSSION: Reaction control subsystem (RCS) primary thruster L1A (S/N 218) was declared failed-off when used during the External Tank (ET) photo DTO maneuver following ET separation. This was the first attempted firing of thruster L1A during the mission. When the fire command was initiated, the thruster chamber pressure indication increased to only 11 psia prior to deselection by redundancy management (RM) at 320 msec. RM declares a thruster failed-off after receiving three consecutive chamber pressure discretes indicating a chamber pressure of less than 36 psia. The nominal chamber pressure for a primary thruster is approximately 152 psia.

Injector tube temperature data indicate both oxidizer and fuel flow occurred. The injector temperature data were inconclusive in determining if the thruster had fired since these temperatures were increasing due to ascent heating from the main engines. Vehicle rate data were also inconclusive in determining if the thruster had fired. During the mission, it was speculated that the oxidizer flow seen in the injector tube temperature data was most probably pilot-valve-only (or limited) flow, which accounted for the low chamber pressure. The oxidizer-valve main- stage probably failed to open fully due to metallic-nitrate contamination of the pilot stage. The RCS primary thruster oxidizer valve has a solenoid- operated pilot stage and a pressure-operated main stage and a failure to operate due to metallic-nitrate contamination is the most common failure mode. The thruster was left deselected for the remainder of the mission. STS-66 was the first flight of the S/N 218 thruster since it was taken from spares and installed on pod LP-03. Prior to that, the vendor had performed a water flush-decontamination procedure on the thruster that should have removed most, if not all, of the metallic-nitrate contamination in the oxidizer valve. The thruster had seen 5 months of vapor/liquid exposure and 2 weeks of liquid propellant exposure prior to flight. Formation of metallic-nitrate contamination is considered to be a time-dependant phenomenon, and it was not expected that quantities large enough to cause a fail-off could be formed over a short period of time without some other mechanism, such as extensive valve leakage. It was reported by KSC that thruster L1A did experience heavy oxidizer vapor leakage after propellant loading. Thruster L1A was removed and replaced at KSC and sent to the White Sands Test Facility (WSTF) for failure analysis. The S/N 218 thruster has a -503 configuration oxidizer valve which is not eligible for water flushing at the WSTF. Additionally, a failure analysis was desired because this failure did not fit perfectly the metallic-nitrate contamination failure scenario (the short propellant exposure time). The failure analysis at the WSTF did find

significant metallic-nitrate contamination in the oxidizer valve at the pilot poppet and seat. No other problems were found, and therefore, the contamination was considered to be the cause of the fail-off. This failure indicates that with a valve leak, significant quantities of metallic-nitrate contamination can be formed in a short time period. CAUSE(s)/PROBABLE Cause(s): The cause of the thruster fail-off was metallic- nitrate contamination in the oxidizer-valve pilot-stage that prevented its proper operation. CORRECTIVE_ACTION: KSC removed and replaced thruster L1A and the thruster was transferred to the WSTF for failure analysis. Results of the failure analysis will be documented in CAR 66RF01. Due to the frequency of primary thruster failures, a team was formed to look into the causes of the failures and consider solutions. These solutions include possible hardware changes for the future and processing changes for the near term. Among the recommended processing procedures many are already in place. Metallic-nitrate contamination, the cause of the fail-off, is assisted by the presence of water (moisture) in the oxidizer system. Therefore, the primary thruster throat plugs are installed during turnaround to reduce the likelihood of moisture intrusion into the propellant system. Also, RCS break-ins are minimized to preclude the introduction of contamination and the propellant manifolds are maintained whenever possible at an elevated pad pressure to maintain sealing integrity. Periodic water flushing of the valves, hardfilled-manifold pod processing, and improved thermal conditioning for all flow phases, are among several proposed processing changes that are being considered. A program to develop a direct- acting valve, which would be less susceptible to failure from metallic-nitrate contamination, is currently in progress. Additionally, an evaluation of modifications to improve the existing valve will be pursued. RATIONALE FOR FLIGHT: System redundancy is adequate to support the failure rate of the primary RCS thrusters. There have been no changes to the thruster design or to the RCS turnaround processing procedures that would adversely affect this failure rate.

Tracking No	**Time**	**Classification**	**Documentation**		**Subsystem**
MER - 0	**MET:**	Problem	**FIAR**	**IFA** STS-66-V-02	MECH
MMACS-01	**GMT:**		**SPR** 66RF02	**UA**	**Manager:**
			IPR 71V-0003	**PR**	
					Engineer:

Title: Starboard PLBD Aft RTL 3 and Close 2 Indications Failed On (ORB)

Summary: INVESTIGATION/DISCUSSION: Following ascent on STS-66, payload bay door (PLBD) opening was completed at 307:18:29 G.m.t. (00:01:30 MET). During the door opening sequence, all operations were performed on dual motors within the specified allowable time. However, when the starboard PLBD was opened, the aft ready-to-latch (RTL) 3 and the close 2 indications did not transfer off. Approximately 38 and 44 minutes later, both indications transferred to their correct state. The anomaly did not recur.

There are four PLBD switch modules on each vehicle, located on the port and starboard sides of the forward and aft bulkheads. Each switch module contains three RTL limit switches and one door closed limit switch. The door-closed limit switches turn off the PLBD drive motors, and the RTL limit switches (2 of 3) enable the bulkhead latches. The PLBD switch modules have a history of inflight anomalies attributed to rigging problems, and the anomaly on STS-66 was similar to those seen in the past. In January 1986, the rigging procedure for the switch modules was revised and in recent years, a rework of the switch modules has been performed on an attrition basis. This new procedure clarifies rigging instructions, requires the potting of set screws after adjustment, and requires replacement of all switches with particle induced noise detection (PIND)-tested limit switches. The aft starboard switch module on OV-104 was the only one on this vehicle that had not been reworked. Therefore, prior to the end of the mission, the decision was made to remove and replace this switch module . Troubleshooting was performed on the vehicle at KSC and the anomaly was not reproduced. The switch module was removed and replaced with a reworked switch module. The switch module from OV-104 was sent for evaluation and rework. Prior to performing the teardown evaluation, an acceptance test procedure was performed. During this test, occasional occurrences of the anomaly with the RTL switch were seen. The anomaly with the door closed switch did not recur. As expected, the evaluation showed that the switch module was not rigged per the original drawing requirements. The running torque on the set screws of the failed RTL switch was measured at 0 in-oz. This probably allowed the set screws to migrate over time, contributing to the out-of-rig condition. CAUSE(s)/PROBABLE Cause(s): The cause of the anomaly was improper rigging in the starboard aft bulkhead PLBD switch module. CORRECTIVE_ACTION: The aft starboard PLBD switch module was removed and replaced with a reworked switch module. This rework, which was first implemented in January 1986, is done with clarified rigging instructions and requires the potting of set screws after adjustment as well as the replacement of all microswitches with PIND-tested limit switches. The replacement of switch modules with reworked modules was being done on an attrition-only basis. At the time of this anomaly, none of the four switch modules had been reworked on OV-102, and one switch module out of four had not been reworked on OV-103 and OV-104. OV-105 was built with a complete set of reworked switch modules. Since this anomaly, the only switch module in the fleet requiring rework is the forward port switch module on OV-103. Rework of this switch module is planned for the OV-103 Orbiter maintenance down period (OMDP) following STS-70. RATIONALE FOR FLIGHT: The aft starboard switch module was removed and replaced with a reworked switch module. Workarounds are available for all failure modes of the switch module. Should a close-indication failure inhibit a PLBD drive motor, the doors can be driven on a single motor. Also, an inflight workaround exists (Malfunction Procedure MECH SSR-6) to remove the PLBD drive- motor inhibit. Only two of three RTL indications are required to enable latch operation in the auto mode. The RTL indications will not inhibit latch-motor operation.

Tracking No	**Time**	**Classification**	**Documentation**		**Subsystem**
MER - 0	**MET:**	Problem	**FIAR**	**IFA** STS-66-V-03	FC/PRSD
EGIL-02	**GMT:**		**SPR** 66RF04	**UA**	**Manager:**
			IPR 71V-0005	**PR**	x39034
					Engineer:

Title: FC 2 Alternate H2O Line CV Leakage (ORB)

Summary: INVESTIGATION/DISCUSSION: The fuel cell 2 (FC 2) alternate water line temperature increased from 84 to 138 ?F over a one-hour period beginning at 307:18:00 G.m.t. (00:01:00 MET). This indicates warm fuel cell product water was flowing through the FC 2 alternate water line check valve. The temperature remained steady in the 130 to 140 ?F range throughout the flight. The temperature of the FC 2 product water line was nominal (ranging between 140 and 145 ?F) indicating that a low percentage of FC 2 product water was being diverted through the alternate water line by the leak. Leakage through this check valve at lower flow rates (indicated by lower and more erratic alternate water line temperature) was first observed on STS-43 and was accepted for reuse.

Leakage through the FC 2 alternate water line check valve was confirmed during ground testing, and the check valve was replaced and satisfactorily retested. The faulty valve was sent to Rockwell-Downey for failure analysis. The preliminary findings of the failure analysis have determined that leakage through the FC 2 alternate water line check valve occurred because the valve's O-ring seating surface had deteriorated over time. Failure analysis is continuing in an attempt to determine what caused the valve's elastomeric seating material to deteriorate. Final results of the failure analysis will be documented in CAR 66RF04. Leakage through a fuel cell alternate water line check valve diverts some of the water produced by a fuel cell away from supply water tank A for crew consumption into other supply water tanks. Alternate water line check valves with lower leak rates characterized by lower and more erratic alternate water line temperature have been previously identified and accepted for flight. The performance of alternate water line check valves is routinely observed in flight, and check valves which are known to leak are assessed for signs of further degradation. When alternate water line check valves leak badly enough to allow a steady flow of product water to be diverted through the alternate water line, they are considered unacceptably degraded and are replaced. CAUSE(s)/PROBABLE Cause(s): Preliminary findings of the failure analysis indicate that leakage through the FC 2 alternate water line check valve occurred because the valve's O-ring seating surface had deteriorated over time. Failure analysis is continuing in an attempt to determine what caused the valve's elastomeric seating material to deteriorate. Final results of the failure analysis will be documented in CAR 66RF04. CORRECTIVE_ACTION: The FC 2 alternate water line check valve was replaced and satisfactorily retested. The removed valve was sent to Rockwell-Downey for failure analysis. Final resolution will be documented in CAR 66RF04. RATIONALE FOR FLIGHT: The leaking alternate water line check valve was replaced and satisfactorily retested. The elastomeric seal deterioration that resulted in FC 2 alternate water line check valve leakage appears to be a relatively slow process; therefore, check valves should not be expected to degrade from acceptably low known leakage to diversion of all product water flow from one mission to the next. A mission will not be affected unless the alternate water line check valves for all three fuel cells leak so badly that the total product water flow into supply tank A is reduced below crew consumption rates that will result in eventual depletion of iodized water.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:**	Problem	**FIAR**	**IFA** STS-66-V-04	Hydraulics
MMACS-02	**GMT:**		**SPR** 66RF05	**UA**	**Manager:**
			IPR IPR 71V-0023	**PR**	
					Engineer:

Title: WSB 3 GN2 Regulator Outlet Pressure Decay (ORB)

Summary: INVESTIGATION/DISCUSSION: The water spray boiler (WSB) 3 GN2 regulator outlet pressure began decreasing following WSB deactivation after ascent. At WSB deactivation, the regulator outlet pressure was 27.5 psia. At 309:14:00 G.m.t. (01:21:00 MET), about 45 hours later, the pressure had decayed to 21.9 psia, which corresponded to an initial leak rate of approximately 0.124 psi/hr. The rate of regulator pressure decay was exponential which is charateristic of regulator GN2 leaks observed in the past. The final pressure prior to the deorbit maneuver was 15.3 psia. The leakage seen on-orbit resulted in the failure of the OMRSD File IX requirement (DV58AKO.045)

The regulator outlet pressure decay can be caused by the loss of GN2 past the relief valve or by water loss. The WSB GN2 shutoff valve is closed once on- orbit to prevent the loss of GN2 from the GN2 tank. For deorbit operations, the GN2 shutoff valve is opened to pressurize the water tank. Only after GN2 isolation valve opening can a distinction between a GN2 leak or a water leak be made. The GN2 tank quantity is able to accommodate a low-magnitude relief valve leak; however, a large leak may result in the loss of a hydraulic system. The regulator outlet pressure decay was suspected to be caused by a compression set taken by the relief valve poppet seal (consisting of a silicone compound). The poppet seal experiences a constant spring load that causes it to deform and over time take on a compression set. In the failure analysis of past failed regulators, it has been observed that the poppet seal decreases from a 0.004 to 0.005 inch squeeze of the silicone to a 0.001 inch squeeze following compression set. The relief valve poppet seals will be replaced on a 5 year limited life maintenance plan following program approval. This regulator (s/n 016) was installed on WSB s/n 009 on OV-102 prior to STS-5 and flew eight flights through STS-50. After STS-50, the WSB was removed due to a pinhole leak in the heat exchanger core. During this time, the regulator poppet assembly was replaced changing the regulator from a -001 to a -004 configuration. STS-66 was the first flight since STS-50 (6/92) for this WSB and regulator. The regulator poppet seal was exposed to the relief valve spring load for 4 years and 8 months. KSC troubleshooting included a crack and reseat test of the GN2 regulator. A decay test was also performed with indeterminate results. The decision was made to replace and upgrade the WSB 3 regulator along with the other two WSB regulators. The exposure to spring force on the three replacement regulator's relief valve poppet seals was approximately 2 months when installed in the Orbiter. CAUSE(s)/PROBABLE Cause(s): The most probable cause of the regulator outlet pressure decay is the compression set taken by the relief valve poppet seal. The silicone seal experienced a constant spring load for 4 years and 8 months. CORRECTIVE_ACTION: The WSB 3 GN2 regulator was removed and replaced along with the other two WSB regulators. The regulators also passed the LRU checkout tests. The failure analysis of the WSB 3 regulator will be reported in CAR 66RF05. RATIONALE FOR FLIGHT: The WSB isolation valves are closed when the WSB's are no longer required to reduce the risk of regulator leakage. If the regulator were to develop a major leak on-orbit and the WSB system was declared lost, the auxiliary power unit (APU) can be started at terminal area energy management (TAEM) to prevent over-heating of the APU. The Orbiter is certified to function with two of three APU's, if a WSB system is lost due to a gross leak during ascent or entry.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:**	Problem	**FIAR**	**IFA** STS-66-V-05	Active Thermal
EECOM-03	**GMT:**		**SPR** 66RF06	**UA**	**Manager:**
			IPR 71V-0021	**PR**	x30663
					Engineer:

Title: FES Outlet Temperature Sensor (V63T1207A) Response Lag (ORB)

Summary: INVESTIGATION/DISCUSSION: The thermal response of the Freon coolant loop (FCL) 1 flash evaporator system (FES) outlet temperature sensor (V63T1207A) lagged the FCL 2 FES outlet temperature response. During FES start-up on ascent, when the largest temperature transients were experienced, the FCL 1 temperature sensor lag resulted in a temperature difference of 11? F when the crew switched the FES controller from GPC to ON. During stable periods, the temperature difference was approximately 1.5? F. The FES outlet temperature measurements are not part of the FES control loop but are used for ground insight only.

Postflight troubleshooting at KSC revealed that the temperature sensor was debonded. This is a common failure mode for this type of 'paste-on' temperature sensor. The sensor was removed and replaced. No failure analysis was performed, and the failed sensor was discarded. CAUSE(s)/PROBABLE Cause(s): The cause of the FCL 1 FES outlet temperature lag was the debonding of the outlet temperature sensor from the Freon line. CORRECTIVE_ACTION: The FCL 1 FES outlet temperature sensor was removed and replaced. A test of the Freon loop with the new sensor shows that the new sensor is providing proper temperature readings. RATIONALE FOR FLIGHT: Should this sensor fail or become debonded on a future flight, some ground insight into the Freon loop operation will be lost, however, there will be no impact to the active thermal cooling system (ATCS) or FES performance.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:**	Problem	**FIAR**	**IFA** STS-66-V-06	Active Thermal
EECOM-02	**GMT:**		**SPR** 66RF07	**UA**	**Manager:**
			IPR 71V-0020	**PR**	x39045
					Engineer:

Title: FES Pri A Oscillations at Low Heat Loads. (ORB)

Summary: INVESTIGATION/DISCUSSION: During flash evaporator system (FES) operations on flight day 2, while using the primary A controller, several periods of an unusual oscillation in the outlet temperature were noted. These oscillations were 2? F to 3? F in magnitude and occurred only at low heat loads (the FES inlet temperatures were in the 40? F to 45? F range). Control was switched to the FES primary B controller at 311:13:25 G.m.t. (03:20:25 MET). No low-heat- load oscillations in the FES outlet temperatures were observed while using the primary B controller. The primary A controller was again enabled at 316:16:55 G.m.t. (08:23:55 MET) and similar outlet temperature oscillations recurred at low heat loads. None of the temperature excursions were of sufficient duration to cause a FES shutdown. Temperature oscillations of this type have not been observed on past flights during normal FES operations. As a result of the subsequent primary B controller problems (IFA STS-66-V-13), the primary A controller was used during entry with nominal performance under the high heat loads experienced during this phase of the mission.

During a postflight leak check, the primary A water spray valve was observed to be leaking at a rate of one drop every seven seconds. The maximum topping valve leak specification is one drop every five minutes, and the normal leakage is zero drops in five minutes. A leak of this magnitude will affect the spray pattern of the leaking valve at low valve-pulse-rates (i.e., low heat loads), resulting in oscillations in the outlet temperature. The leaking primary A spray valve was replaced and a leak check performed on the replacement valve. The valve has been returned to the vendor for failure analysis. The results of this failure analysis will be documented on CAR 66RF07-010. CAUSE(s)/PROBABLE Cause(s): The cause of the temperature oscillations observed during the flight at low heat loads was a leaking primary A water spray valve. CORRECTIVE_ACTION: The leaking water spray valve was removed and replaced. The replacement valve passed a leak check. The leaking valve was returned to the vendor for failure analysis. RATIONALE FOR FLIGHT: The outlet temperature oscillations observed during STS- 66 were of short duration and did not affect the ability of the FES to provide Orbiter cooling, even at low heat loads. Should the duration of the oscillations increase, the FES may experience a shutdown; however, a power cycle of the controller is all that is needed to allow the FES to restart. Should the other primary controller and the secondary controller fail, a FES controller experiencing these types of temperature oscillations will still be able to provide adequate cooling to the vehicle, as was demonstrated during the latter portion of this mission.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:**	Problem	**FIAR**	**IFA** STS-66-V-07	C&T - Ku-band
INCO-02	**GMT:**		**SPR** 66RF08	**UA**	**Manager:**
			IPR 71V-0024	**PR**	x31450
					Engineer:

Title: NSP2/Ku-Band Interface Channel 1 Failure ()

Summary: INVESTIGATION/DISCUSSION: At approximately 311:12:30 G.m.t. (003:19:30 MET), on Orbit 61W with the network signal processor-2 (NSP-2) configured for two- way Ku-Band, both White Sands and the Second tracking and data relay satellite (TDRS) ground terminal (STGT) observed channel 2 and channel 3 data on the downlink, but did not observe modulation on channel 1 for several passes. NSP -2 was configured for S-band with coding OFF to observe Ku-Band channel 1. Ku-Band channel 1 modulation was not observed. On Orbit 66W, the link was configured using the alternate NSP. Both White Sands and the STGT observed Ku- Band channel 1 modulation. Symptoms indicated a problem in the interface or the logic driving the interface between NSP-2 and the Ku-Band signal processor (KUSP). NSP-2 was reselected at 317:22:27 G.m.t. (10:05:27 MET) and nominal Ku-Band channel 1 modulation was observed with and without coding.

Postflight, both S-band and Ku-Band systems were powered on and wiggle checks were performed on the NSP-2 to the signal processor assembly (SPA) data and data-select lines. Also, a total of five Ku-Band standby-to-on system power cycles were performed. The anomaly, however, was not reproduced. Since the cause of the anomaly can only be attributed either to ground terminal errors or hardware/wiring failures within the Orbiter, analysis of this anomaly was focused on those areas. To determine the most probable cause of the anomaly, each of the following areas were evaluated: NSP-2, KU-band system, forward load control assembly (FLCA) -3, ground control interface logic (GCIL), and Ground Terminals and TDRSS's. 1. NSP-2 Because of the following findings, an intermittent failure in the line driver in NSP-2 associated with the SPA would be the only probable cause in the NSP-2 for the anomaly: a. The return link was provided simultaneously to both S-band transponder-2 and the SPA through dedicated wires and line drivers during the anomaly. b. S-band return link modulation was present during the anomaly. The NSP failure history, however, shows no prior failures for this particular line driver. Furthermore, a TTL line driver rarely exhibits intermittent failures. Thus, intermittent line driver failure is not likely to be the cause of the anomaly. 2. Ku-Band system From the flight data recorded, observations provided by ground terminals, and the design of the SPA, the following has been learned: a. No switching of the NSP's was found prior to or during the anomaly. b. NSP-2 was powered on prior to and during the anomaly. c. Ku-Band channel 2 and 3 return links were reported to be working properly during the anomaly. d. SPA's data source selection logic is designed to maintain the last valid configuration even in the event of a missing

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:**	Problem	**FIAR**	**IFA** STS-66-V-08	MPS
	GMT:		**SPR** 66RF09	**UA**	**Manager:**
			IPR 71V-0007	**PR**	x39037
					Engineer:

Title: Engine 1 LH2 Inlet Pressure Response (ORB)

Summary: INVESTIGATION/DISCUSSION: Approximately two and one-half minutes after STS-66 liftoff, the Space Shuttle Main Engine (SSME) 1 liquid hydrogen (LH2) inlet pressure (V41P1100C) dropped from approximately 24.5 psia to 22 psia and then gradually recovered to 27 psia within two minutes. It should have remained steady. Data review revealed that a similar signature in the same timeframe has occurred on every flight of OV-104 since STS-34 (flight 5), when this pressure transducer was installed. The data are not believed to be real because an actual pressure drop at the inlet would be accompanied by a corresponding change in the low pressure fuel pump turbine speed. No such turbine speed change was present. However, a transient instrumentation failure mode that repeatedly occurs in the same timeframe each flight is not clearly understood.

Troubleshooting on the vehicle did not duplicate the failure. Even though the signature of the failure does not correspond to any currently known instrumentation-failure mode, the transducer [serial number (s/n) 138] is assumed to be the source of the problem. It was removed and replaced with s/n 207. No further work is planned until the next flight of this vehicle, when the data from s/n 207 will be compared with the anomalous signatures observed. This measurement is used primarily for engineering evaluation during loading. This measurement is not required during loading or ascent, but it is monitored informally during different phases of propellant loading and recirculation pump startup. A secondary and more recent use of this measurement is in support of Flight Rule 5-72, Main Propulsion System (MPS) Dump Inhibit. In the event of a premature engine shutdown, the LH2 inlet pressure will be monitored post-main engine cutoff (MECO). If the measurement reads greater than 30 psia, this provides confidence that the SSME and Orbiter plumbing are still intact and that performing a nominal LH2 dump through the SSME should not introduce any additional hazard to the vehicle. If the measurement reads less than 30 psia (which may indicate a leak) or is believed to be suspect, the LH2 dump through that SSME would be inhibited by manually closing the associated prevalve and powering down the controller for that SSME. This will prevent LH2 from leaking into the aft compartment or feeding a potential fire that may have resulted from an uncontained SSME shutdown. Should the failure recur inflight and an SSME fail, the MPS dump through the failed engine would be inhibited and would be performed through the remaining two engines. A similar failure occurred on STS-49, when the SSME 1 inlet pressure transducer drifted down 3.5 psia. This drift occurred later in the ascent profile than this STS-66 drift, and remained biased low, unlike the response noted on STS-66. This transducer was removed and underwent testing after STS- 49. A shift in calibration was noted in the transducer when it was evaluated, but no destructive analysis was performed. The anomaly did not recur on the next flight of OV-105. CAUSE(s)/PROBABLE Cause(s): The most likely cause of this signature is the pressure transducer. The pressure drop signature after SRB separation was first observed on the flight immediately following this transducer being installed and has been present during every flight since that time. CORRECTIVE_ACTION: The pressure transducer (s/n 138) was removed and replaced. Data review will resume after the next flight

of this vehicle to confirm that there is no recurrence of the failure. RATIONALE FOR FLIGHT: This is believed to be an instrumentation-only failure, and the offending transducer has been removed. The failure is not considered generic. Additionally, recurrence of the failure is only significant in the event of an engine failure.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	MET:	Problem	FIAR	IFA STS-66-V-09	DPS - GPC
DPS-01	GMT:		SPR	UA	Manager:
			IPR 71V-0010	PR	x38359
					Engineer:

Title: GPC 4/MMU 1 Interface Problem (ORB)

Summary: INVESTIGATION/DISCUSSION: During STS-66 on-orbit operations at 314:22:01 G.m.t. (07:05:01 MET), while the crew was performing a systems management (SM) checkpoint with general purpose computer (GPC) 4, the GPC annunciated an input/output (I/O) error fault message against mass memory unit (MMU) 1 and a checkpoint fail message. A retry of the transaction was successful. Six successful accesses of MMU1 were performed before another failure was indicated at 315:13:18 G.m.t. (07:20:18 MET). Further recovery procedures were unsuccessful in reestablishing the interface between GPC 4 and MMU 1. MMU 2 access was unaffected. GPC 1, the guidance, navigation, and control (GNC) GPC, was used to confirm the health of MMU 1, leaving GPC 4 as the most likely cause of the problem. The SM function was moved to GPC 3 without incident, and GPC 4 was configured as a GNC machine and put in the redundant set with GPC 1. GPC 4 performed as expected for the remainder of the flight, with no recovery of its interface with MMU 1.

The failure signature indicated either a receiver failure or a transmitter/receiver failure in the GPC bus control element (BCE). This BCE, BCE 18, has a common power supply with BCE 17, which commands flight critical data bus 8. BCE 17 was confirmed healthy, thus isolating the failure to BCE 18. The BCE 18 failure repeated in ground testing and the GPC, serial number (s/n) 524, was removed from the vehicle and returned to the vendor for failure analysis. Analysis performed at the vendor revealed two open pins on a transformer in the multiplexer interface adapter (MIA). The MIA, a standard Orbiter data bus interface, converts inputs from Manchester encoding to non- return-zero (NRZ) encoding and checks parity and bit count. Further failure analysis will be documented with CAR 66RF21. A review of the failure history of GPC s/n 524 revealed that it has sustained no previous failures. However, there has been one similar failure in the history of the Program. It was in 1988 and the open pins were caused by a broken wire in a transformer at the point of termination on pin 1. CAUSE(s)/PROBABLE Cause(s): The cause of the failure was two open pins on a transformer in the MIA. These may have resulted from a broken wire in the transformer. Failure verification at the MIA vendor is pending. CORRECTIVE_ACTION: GPC 4 (s/n 524) was removed and replaced with s/n 536. Failure analysis is on-going at the vendor. RATIONALE FOR FLIGHT: The offending GPC has been removed from flight spares. Due to the rarity of previous failures of this type, this is not considered a generic trend.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	MET:	Problem	FIAR	IFA STS-66-V-10	Water and Waste

EECOM-06	**GMT:**		**SPR** 66RF10	**UA**	**Manager:**
			IPR 71V-0013	**PR**	
					Engineer:

Title: Ice Formation During Supply Water Dump (ORB)

Summary: INVESTIGATION/DISCUSSION: During video downlink at G.m.t. 315:15:56 (07:22:56 MET), of a simultaneous waste and supply water dump, a

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Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:**	Problem	**FIAR**	**IFA** STS-66-V-11	OMS/RCS
PROP-02	**GMT:**		**SPR** 66RF14	**UA**	**Manager:**
			IPR 71V-0008	**PR** LP01-18-0482	x39030
					Engineer:

Title: LRCS 3/4/5 Crossfeed Fuel Valve Operation (ORB)

Summary: INVESTIGATION/DISCUSSION: The reaction control system (RCS) was reconfigured from interconnect to straight feed at 317:05:42 G.m.t. (09:12:42 MET). As part of the reconfiguration, the left RCS 3/4/5 crossfeed valves (LV273 and LV274) were switched closed. Telemetry showed toggling on the AC1 bus current, aft motor controller assembly (AMCA) 1 operational status (op stat), and closed fuel valve (LV273) position measurements. The crew reported that the onboard talkback for the valve pair indicated closed. Data indicated that the fuel valve's open position indicator turned off nominally when the valve pair was switched closed. System pressures confirmed the valve cycled sufficiently to seat in the closed position and to actuate one of the two closed-position microswitches (the one for the onboard talkback), but the second closed-position microswitch circuit for valve control logic and ground telemetry was intermittent resulting in application of intermittent drive power to the valve after it had closed.

The crew cycled the crossfeed valve switch from CLOSE through GPC to OPEN, back through GPC to CLOSE, and then to GPC at 317:05:47 G.m.t. (09:12:47 MET). System pressures indicated that the valve remained closed, but after the first movement of the switch from CLOSE to GPC, the downlinked fuel valve closed position indication stopped toggling and remained off and the onboard talkback changed to barberpole. Data indicated that the phase A and B thermal switches had opened just prior to the attempted valve cycle; therefore, the valve did not cycle since at least two phases must be available to drive an AC motor valve (ACMV). The switch was left in GPC after the attempted cycle to remove power from the valve. After allowing the valve to cool and the thermal switches to reset closed, the crew cycled the left RCS 3/4/5 crossfeed valve switch from GPC to OPEN, through GPC to CLOSE, and then back to the GPC position at 317:08:15 G.m.t. (09:15:15 MET). All available data indicated the fuel valve operated nominally, with no recurrence of the anomaly. The valve had also been cycled nominally twice prior to the anomaly. During entry, with the valve closed and the onboard switch in GPC, the downlinked fuel valve closed position indication turned off. Data indicated that the valve had not been commanded or powered, and the valve remained seated. No report was received from the crew regarding the onboard talkback indication. Valve cycling operations performed postlanding were nominal, and the closed indication was restored. Vapor sniff checks of the ACMV actuator were nominal. Detailed electrical testing of the actuator and valve position indication circuitryusing a break- through box were nominal. Connector and wiring inspections and wire-wiggle testing at the valve actuator were nominal. Break-away and running-torque checks of the ball valve with the ACMV actuator removed were nominal in both directions. A replacement actuator was installed on the valve, and retests were satisfactorily completed. Additional vehicle wiring inspections and wire- wiggle tests between the left pod interface and avionics bay 4 up to the AMCA 1 interface and between avionics bay 4 and avionics bay 6 up to the multiplexer/demultiplexer (MDM) flight-aft (FA) 4 interface were nominal. Wiring inspections and wire wiggle tests within the left pod between the pod interface and the ACMV will be performed when the pod is removed. The removed ACMV actuator was sent to Parker Hannifin for failure analysis. No discrepant conditions were detected in the valve position microswitches, and no unusual wear in the sector gear assembly for microswitch activation was noted. Prior failures of ACMV position indication microswitches have been attributed to particle contamination within the sealed switch assembly causing the switches to fail open. This actuator contained microswitch assemblies that had been particle impact noise detection (PIND) tested, and failure analysis of the switches did not find contamination and did not identify a possible cause. The most probable cause of this anomaly is an intermittent open circuit in the closed valve position indication circuitry for control logic and telemetry between LV273 and AMCA 1. The problem is probably located in the left pod wiring, which has not been fully tested due to access restrictions with the pod installed. When an ACMV is manually switched to change position, drive power stays on until the valve position indicates the valve has reached the commanded position. If the valve position indication fails, drive power remains on and the ACMV actuator heats until thermal switches in the actuator open to remove the power. The crew can also remove drive power by moving the valve switch to the GPC position. If the position indication fails open, the thermal switches fail closed, and the crew fails to take action, damage to the ACMV actuator may result which would prevent future operation of the valve. CAUSE(s)/PROBABLE Cause(s): The most probable cause is an intermittent open circuit in the left RCS 3/4/5 fuel crossfeed valve (LV273) closed valve position indication circuitry for control logic and telemetry between the ACMV and AMCA 1. The problem is probably located in the left pod wiring, which has not been fully tested due to access restrictions with the pod installed. CORRECTIVE_ACTION: Vehicle troubleshooting and ACMV failure analysis activities were unable to reproduce or find a cause for the anomaly. A replacement ACMV actuator was installed and successfully retested. Testing of left pod wiring between the ACMV actuator and the pod interface has been deferred until pod removal permits access. RATIONALE FOR FLIGHT: The anomaly has not affected the ACMV's ability to cycle properly. If the anomaly recurs, drive power can be removed from the valve by moving the switch to the GPC position. If power is not manually removed from the valve, thermal switches in the actuator will protect the actuator from damage caused by overheating.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:**	Problem	**FIAR**	**IFA** STS-66-V-12	APU
MMACS-08	**GMT:**		**SPR** 66RF15	**UA**	**Manager:**
			IPR 71V-0011	**PR**	
					Engineer:

Title: APU 1 Supply Line Temperature Decrease (ORB)

Summary: INVESTIGATION/DISCUSSION: During entry, about 8 minutes after auxiliary power unit (APU) 1 start, the APU 1 gas generator valve module (GGVM) fuel supply line temperature (V46T1171A) decreased from 80 ?F to 52 ?F over a 25-minute period. Just prior to touchdown, the temperature began to increase. All other APU 1 parameters were in the nominal range. As a precaution, APU 1 was shut down shortly after wheels stop. A sniff check and visual inspection of the APU were performed at Dryden Flight Research Center (DFRC), and no evidence of a fuel leak was found.

Once the vehicle returned to KSC, troubleshooting was performed on the APU 1 supply line temperature sensor and associate wiring. The temperature stayed constant during wire wiggling; however, the temperature decreased while a technician was pinching a wire splice (50SP4088, 89, 90). The splices were removed and sent to JSC for failure analysis. The failure analysis determined that the splices were good and contained no anomalous condition that would cause the signature observed during entry. The APU 1 was removed and replaced because of the GGVM 21-month wetted-life limit. The temperature sensor is located on the APU. The APU and the temperature sensor were tested at the vendor. The test results indicated the APU and the sensor were operating nominally. After the new APU was installed in position 1, the problem recurred during an over-temperature thermostat check. The new splices, wiring and signal conditioner were tested with nominal results. The thermocouple reference junction (TRJ) s/n 590 was then replaced as the probable cause of the failure, but testing and x-ray at the KSC Failure Analysis Laboratory could not repeat the failure or identify any anomalous conditions within the TRJ. A review of the TRJ failure history found that CAR AC4219 was written on TRJ s/n 590 in 1982, but the unit was returned to stock when testing could not repeat the anomaly, and later was installed on OV-104. The replacement TRJ (s/n 1006) was installed and retested, where the original failure symptoms did not repeat but a 25? F bias was observed. TRJ s/n1006 had previously flown as part of the OV-102 Developmental Flight Instrumentation program, and was placed in spares after termination of the program. After re-verification of the signal path and the replacement of the splices, a new, unused TRJ (s/n 1000) was install and the temperature measurement read nominally. The failure analysis of the two TRJs will be conducted under CAR 66RF15. CAUSE(s)/PROBABLE Cause(s): The cause for the APU 1 GGVM fuel supply line temperature decrease observed during entry is believed to be the TRJ. CORRECTIVE_ACTION: Initial troubleshooting determined the cause to be wiring splices which were replaced. Failure analysis determined the splices were good. APU 1 was removed and this also changed the affected temperature sensor. With the new APU in place, the problem was rediscovered during normal checkout. The new splices, wiring and signal conditioner were tested, and the results were nominal. The TRJ was considered suspect and was replaced. The TRJ was sent to the KSC Failure and Analysis Laboratory with no anomalous condition found. With the replacement TRJ in place, the in-flight signature did not manifest itself but a 25? F bias was observed. The splices were replaced and the signal conditioner and multiplexer-demultiplexer (MDM) were tested again with no cause for the bias determined. A new TRJ was installed and a nominal temperature measurement reading was noted. The original and replacement TRJs were sent to the KSC Failure Analysis Laboratory. The failure analysis will be documented in CAR 66RF15. Both TRJ's will be removed from the flight spares regardless of the testing and failure analysis results. RATIONALE FOR FLIGHT: If the GGVM supply line temperature is erratic or lost, additional measurements are available to determine the health of the APU. If this measurement or other measurement indicates a fuel leak, the APU will be shut down, and the fuel will be isolated to prevent additional leakage. The Orbiter is certified to function with two of three APU's during ascent or entry.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	MET:	Problem	FIAR	IFA STS-66-V-13	Active Thermal
EECOM-04	GMT:		SPR 66RF16	UA	Manager:
			IPR 71V-0020	PR	x39045
					Engineer:

Title: FES Pri B Shutdowns and Oscillations. (ORB)

Summary: INVESTIGATION/DISCUSSION: The flash evaporator system (FES) experienced an over-temperature/rate shutdown at 311:13:26 G.m.t. (03:20:26 MET) during its first start-up on the primary B controller. The power to the primary B controller was cycled and a normal start-up was observed. Similar data signatures (but no shutdowns) occurred on STS-38 and STS-64 at the first start- up of the primary B controller. Both flights had the FES changed out preflight, as was the case for STS-66. During the change-out, a small amount of air may be trapped in the water system accumulator. When this air is expelled during FES start-up, it results in a loss of cooling when it passes through the spray valves, causing a brief disruption in cooling and possibly a shutdown.

At 318:10:05 G.m.t. (10:17:06 MET), the FES primary B controller experienced an under-temperature shutdown while in the topping mode. The power to the primary B controller was cycled and the FES operated normally until the radiator bypass mode was selected. Following the radiator bypass/FES checkout, several large temperature transients occurred while on the primary B controller with the full-up FES (high load and topping active). Although the evaporator outlet temperature oscillated between 34? F and 47? F, the transients did not last long enough to cause the FES to shut down. The control temperature is set at 39? F ? 1? F. The primary A controller was selected at 318:12:04 G.m.t. (10:19:04 MET) and used for the remainder of the mission. During postflight testing at KSC, it was discovered that the mid-point control sensor was reading high. The effect of this failure in topping mode is to cause the FES to spray too much water, resulting in an under-temperature shutdown. In the FES full-up mode, the pulse frequency will change to correct an apparent error, resulting in oscillations occurring in the outlet temperature. Data from the mid-point control sensor does not appear in the downlist, so there is no insight into its health during a flight. This is the second in-flight failure of this sensor, with the first occurring during STS-3. CAUSE(s)/PROBABLE Cause(s): The most probable cause of the FES shutdown on the initial primary B controller start-up was trapped air being expelled. The cause of the FES under-temperature shutdown and the temperature oscillations while using the primary B controller was a failure of the primary B mid-point temperature sensor. The midpoint control sensor failure caused over-cooling and under-temperature shutdowns in topping mode. If the full-up mode, the failed sensor caused “controller confusion” and temperature oscillations. CORRECTIVE_ACTION: The primary B mid-point control sensor has been replaced and the new sensor has been verified to provide proper temperature readings. No corrective action is required for the first primary B over-temperature/rate shutdown. RATIONALE FOR FLIGHT: These failures will have only a minor impact on a mission should they recur. The over-temperature shutdown condition is a no- impact-failure that only requires the power to the controller to be cycled. A failure of a mid-point temperature control sensor results in the loss of function of a FES controller. However, there are two additional controllers, a second primary controller along with a single secondary controller, that are available to provide vehicle cooling. Flight rules specify a minimum duration flight (MDF) if both primary controllers fail.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	MET:	Problem	FIAR	IFA STS-66-V-14	OMS/RCS
PROP-04	GMT:		SPR 66RF17	UA	Manager:
			IPR IPR 71V-0009	PR	
					Engineer:

Title: Thruster R3R Fuel Injector Temperature Failed OSH (ORB)

Summary: INVESTIGATION/DISCUSSION: During entry at approximately 318:15:26 G.m.t. (10:22:26 MET), the primary reaction control subsystem (RCS) thruster R3R fuel- injector temperature (V42T3510C) went off-scale high in a single data sample. This initial indication was followed by two dips in the indicated temperature during the next two minutes after which the indicated temperature remained off- scale high. This anomaly had no mission impact.

Postflight troubleshooting at KSC found a failed-open circuit on the thruster. The troubleshooting isolated the open circuit to the variable- resistor leg of the fuel injector temperature transducer. This failure would bias the bridge circuit in the dedicated signal conditioner (DSC) to a maximum high output, which supports the observed failure. Troubleshooting exonerated the pod- and vehicle-side hardware. Since the temperature transducer is integral to the thruster, thruster R3R was removed and replaced. CAUSE(s)/PROBABLE Cause(s): The cause of the anomaly was a failed-open circuit in the variable-resistor leg of the primary thruster R3R fuel injector temperature transducer. CORRECTIVE_ACTION: Troubleshooting isolated the problem to a failed-open circuit in the variable-resistor leg of the primary thruster R3R fuel injector temperature transducer. Thruster R3R was removed and replaced and sent to the WSTF for failure analysis. The results of this failure analysis will be documented in CAR 66RF17. RATIONALE FOR FLIGHT: Thruster R3R was removed and replaced. Failure history suggests that the anomaly seen during STS-66 is not generic. Loss of a primary-thruster injector-temperature sensor (fuel or oxidizer) results in the loss of leak detection for the affected thruster. However, the thruster would be placed in last priority and could be used, if required.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	MET:	Problem	FIAR	IFA STS-66-V-15	TPS
EECOM-01	GMT:		SPR 66RF18	UA	Manager:
			IPR RSI-0106	PR	
					Engineer:

Title: Damaged Tile Along Aft Edge of Window 8 (ORB)

Summary: INVESTIGATION/DISCUSSION: At approximately 308:22:09 G.m.t. (01:05:09 MET), the crew reported a damaged tile near the port overhead window, W8. The condition was described as a chip in the inboard straight tile along the aft edge of the window. The crew’s description identified the damaged tile as V070-

390068-059. The damage was located along the lip of the tile facing toward the window, and the damaged area was approximately 3? inches long and ? inch deep. On STS-68, this same tile fractured along a plane at the tile densified layer (STS-68-V-01). The thermal assessment performed during STS-68 was used to determine that the STS-66 damage had no mission impact.

All the tiles around windows 7 and 8 receive a detailed inspection after removal of the soft window protective covers. The damaged tile was inspected during the STS-66 launch countdown by a thermal protection system (TPS) engineer and witnessed by a quality person within 24 hours of launch. This hands-on inspection was performed to ensure the condition found on STS-68 was not present on STS-66. The engineers did not note anything unusual with the tile. The review of the flow-field data in the vicinity of the Orbiter's overhead window area indicates that debris strikes would be unlikely. The flow field data indicate that debris would be directed away from the upper portion of the Orbiter instead of being steered toward this area. During the crew debris report, the crew stated that they saw the standard ice particles. They also stated there was a bit of smudging on the front windows as normally seen by prior crews. They stated they saw nothing that was abnormal. While at Dryden Flight Research Center (DFRC), the damaged tile face was densified by applying tetraethyl orthosilicate (TEOS) to the tile material to prevent erosion during ferry flight. At KSC, the tile was removed and replaced with a fibrous refractory composite insulation (FRCI)-12 tile. Thirty-seven observation window tiles have been replaced due to outer-to-inner mold-line cracks. Also, twenty-five observation window aft tiles have been replaced because of stretched strain isolation pads (SIPs) resulting from high ascent-flight loads. The overhead window tile system has been redesigned with FRCI-12 tiles (increased strength) on 0.090-in. SIP (eliminates/reduces stretching). This mandatory modification is effective for OV-102 on flight 18; OV-103 on flight 22; OV-104 on flight 15; and OV-105 on flight 9. During OV-104's Orbiter Maintenance Down Period (OMDP), window 8 was replaced. After the return of the vehicle to KSC, window 8 was determined not to have been properly pressure-tested. The window was removed and replaced with OV-105's window 8, which was damaged during the flow and determined unusable. The window was removed and replaced with OV-102's window. The most probable cause of the tile damage is ground handling because of the several overhead window replacements that occurred during STS-66 processing flow and the low probability of debris contact as indicated by Orbiter flow fields. CAUSE(s)/PROBABLE Cause(s): The most probable cause of the tile damage is ground handling because of the high frequency of overhead window replacements that have occurred and the low probability of debris contact as indicated by Orbiter flow fields. CORRECTIVE_ACTION: The missing tile was replaced with an upgraded 12-lb. tile in accordance with the attrition modification because of the damage-prone nature of the carrier panel tile. Workmanship meetings with engineering, quality, and shop personnel have been held to ensure proper techniques when repairing tiles in this area. RATIONALE FOR FLIGHT: Thermal analysis of entry heating in this area has determined the structural temperatures are acceptable, if this window tile or similar tile are damaged or separated at the densified layer. Also, the inspection of the remaining tile portion and adjacent TPS elements shows no thermal degradation following entry for both STS-68 and STS-66.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:**	Problem	**FIAR**	**IFA** STS-66-V-16	Atmospheric Rev
EECOM-05	**GMT:**		**SPR** 66RF19	**UA**	**Manager:**
			IPR 71V-0033	**PR**	

Engineer:

Title: Av Bay 2 Smoke Detector A Negative Excursions (ORB)

Summary: INVESTIGATION/DISCUSSION: The Orbiter cabin and avionics bay smoke detectors typically indicate smoke concentration values in the range of -250 to +250 micrograms/cubic meter. At approximately 314:03:18 G.m.t. (06:10:18 MET), the avionics bay 2 smoke detector A indicated a shift in smoke concentration to a level of -400 to -600 micrograms/cubic meter. It remained at this level for about 14 hours and exhibited similar shifts of shorter durations until the end of the mission. The redundant detector in avionics bay 2 (detector B) indicated nominal values throughout this period. Smoke detector self tests, which test the light and alarm circuitry, were performed on-orbit and no anomalies were noted. Negative smoke concentration is a meaningless number and it was believed that the detector would still properly detect smoke.

This same smoke detector experienced similar behavior during the previous flight of OV-104 (STS-46). During flight day 2 of that mission, the smoke concentration indication dropped to as low as -700 micrograms/cubic meter for eight minutes and then recovered to nominal values. During the next 16 hours, 5 more drop/recovery cycles of similar magnitude were experienced. After these cycles, no further smoke concentration drops were experienced. The negative excursions were considered to be transient and recoverable, and the sensor was still considered functional for detecting smoke. A self test was successfully performed postflight and the decision was made to fly the detector as-is. Postflight troubleshooting on the vehicle after STS-66 failed to reproduce the anomaly. This troubleshooting included using a breakthrough box to monitor the smoke detector output and compare it with the dedicated signal conditioner (DSC OF1) ouput. The smoke detector was removed and replaced and sent to the NASA Shuttle Logistics Depot (NSLD) for further troubleshooting. This included a performance test per the acceptance test procedure (ATP), and a thermal stress test in a temperature range of 70 to 140 deg F. The anomaly was not reproduced in the performance test. However, during the thermal stress test, it was noted that the smoke detector output began to drop off at temperatures above 127 deg F. This drop-off would manifest itself as a downward shift in the smoke concentration indication. Based on flight data, it cannot be determined whether the detector was at temperatures above 127 deg F when the negative shifts were experienced. Although testing indicates that the cause of the problem is within the smoke detector, the exact cause has not yet been determined. Currently, the vendor is not under contract to perform failure analysis/repair work on the smoke detectors, and the NSLD is not certified to perform the work. An effort is currently underway to certify NSLD to perform the failure analysis/repair work, and if that effort encounters problems, it may be necessary to address the contract with the vendor. CAUSE(s)/PROBABLE Cause(s): The cause of the negative excursions in the avionics bay 2 smoke detector A indicated smoke concentrations is unknown. Thermal stress testing on the smoke detector at NSLD indicates that the detector output drops off when operated at the upper end of its certified operational temperature range. Based on the vehicle and NSLD testing, the problem is believed to be within the smoke detector. CORRECTIVE_ACTION: Following troubleshooting on the vehicle, which did not reproduce the anomaly, the smoke detector was removed and replaced. The detector was sent to the NSLD for further troubleshooting. The smoke detector passed a performance test, however, a thermal stress test found that the smoke detector ouput dropped off when operated at the upper end of its operational temperature range. Failure analysis/repair work will be performed either at NLSD or the vendor. Before that happens, NSLD certification or vendor contractual issues need to be resolved. Results of the failure analysis/repair will be documented on CAR 66RF19. RATIONALE FOR FLIGHT: The smoke detector was removed and replaced. Should a similar anomaly recur, it is

believed that the smoke detector would still adequately detect smoke. However, should a smoke detector fail completely, a redundant smoke detector is available.

Tracking No	**Time**	**Classification**	**Documentation**		**Subsystem**
MER - 0	**MET:**	Problem	**FIAR**	**IFA** STS-66-V-17	DPS - MDM
	GMT:		**SPR**	**UA**	**Manager:**
			IPR 71V-0026	**PR**	x38351
					Engineer:

Title: Bit failure on MDM FA3 Card 3 (ORB)

Summary: INVESTIGATION/DISCUSSION: Approximately 20 minutes after External Tank (ET) umbilical door opening following the STS-66 landing, the ET door aft-centerline latch 2 locked indication 2 (V56X1365X) transferred on for eight seconds and then off. The two stow indications remained on and the locked indication 1 remained off throughout the entire time, indicating that the centerline latch did not move. This discrete is on multiplexer-demultiplexer (MDM) flight critical aft (FA) 3 discrete input high (DIH) card 3 channel 1 bit 14. After vehicle power-up in the Orbiter Processing Facility (OPF), interface testing data revealed that bit 14 on channels 0 and 1 had failed.

Subsequent testing on the vehicle did not duplicate the failure, but the MDM, serial number (s/n) 65, was removed and replaced with s/n 43. When the failed MDM was tested at the NASA Shuttle Logistics Depot (NSLD), the failure was duplicated. Non-standard outputs from a discrete input (DI) 28V receiver hybrid were noted. Further testing revealed high impedance traces on a printed wiring board (PWB) that directly caused the anomalous indication on the receiver hybrid. The failed PWB is one of two whose components together make up the DIH card. The degradation of the board is believed to be due to excessive wear resulting from voltage and temperature cycles. No other contributing factors are known. There is no failure history for this PWB part number, but two other PWB failures on different part numbers have been reported on MDM flight hardware since 1986. There is currently no plan to perform in-depth failure analysis, and this is not considered a generic failure due to the failure history. Further work on this problem will be tracked by CAR 66RF20. CAUSE(s)/PROBABLE Cause(s): The most likely cause of the failure is degradation of the circuit board due to voltage and temperature cycles. CORRECTIVE_ACTION: The MDM, s/n 65, was removed and replaced with s/n 43. The circuit board will be repaired by installing a jumper wire and the MDM will be returned to flight spares after undergoing acceptance test procedures. Further corrective action, if deemed necessary, will be tracked with CAR 66RF20. RATIONALE FOR FLIGHT: The MDM that exhibited this condition has been removed from flight status and will be repaired. Based on the failure history, this is not believed to be a generic failure.